

Columbia University

Department of Economics *Discussion Paper Series*

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Discussion Paper No.: 0607-03

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New York, NY 10027

June 2006

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June 12, 2006

Abstract

This paper examines breakup fees and stock lockups as devices for prospective target firms to encourage bidder participation in takeover contest. We show that, unless bidding costs for the first bidder are too high, breakup fees provide for the socially desirable degree of competition and ensure the efficient allocation of the target to the highest valued buyer in a takeover auction. In contrast, stock lockups permit the target firm to subsidize entry of a new bidder at the expense of an incumbent bidder. Stock lockups induce too much competition when offered to a second bidder and too little competition when offered to a first bidder. Despite their socially wasteful properties, target management would favor stock lockups as they induce takeover competition at least cost to the target.

JEL Numbers: D82, G34, K22.

Keywords: Takeover bidding, Breakup Fees, and Stock Lockups.

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Both authors thank Dennis Gromb, David Skeel, Alan Schwartz, Kathryn Spier, the participants of the 2002 American Law and Economics Association Conference, the editor Ray Deneckere and an anonymous referee for helpful comments. The first author gratefully acknowledges the Graduate School Research Grant at the University of Wisconsin.

1 Introduction

An unprecedented volume of mergers and acquisitions has occurred in the United States within the last decade. Many of these mergers have included *lockup* clauses requiring the target corporations to compensate prospective bidders in case the acquisition is not consummated. Common lockup measures include a fixed cash payment, called a “breakup fee” (or “termination fee”), paid to the losing bidder and a stock option called “stock lockup,” enabling the losing bidder to purchase shares of the target corporation at a reduced price.¹ The frequency and size of lockups are increasing. Almost two-thirds of the merger agreements announced between 1997 and 1999 included breakup payments (Officer, 2002), with stock lockups being used half as often as breakup fees (Coates and Subramanian, 2000). For acquisitions exceeding \$5 billion, the median breakup fee has risen from 1.4 percent to 2.9 percent of the transaction price during the 1997 to 2002 period.²

Despite the increasing prominence of lockups their use remains controversial among legal scholars and financial analysts. Prior analyses largely agree with the “irrelevance” theorem established by Ayres (1990) proclaiming that lockups do not affect the allocational efficiency of takeovers once bidding competition commences with “non-foreclosing bids.”³ Yet, the normative prescriptions on lockups range from one extreme that the courts should validate all lockups (Fraidin and Hanson (1996)) to the other extreme that courts should carefully scrutinize all lockup provisions (Kahan and Klausner (1996)). The controversy stems from conflicting effects of lockups on bidder participation. On the one hand, a lockup encourages participation of a recipient bidder and thus facilitates competition for the target, which can be socially desirable given the sunk costs and informational spillovers from initiating a takeover bid.⁴ On the other

¹A third type of lockup is “asset lockup” which affords a buyer an option to purchase assets of the target (e.g., its subsidiary divisions) when another buyer purchases a significant amount of shares. Asset lockups are almost extinct, however (see Coates and Subramanian, 2000). Note also the standard trigger events for lockups are either consummation of a merger with (or purchase of a significant block of target shares by) a third party or rejection of the deal with the recipient by target shareholders. Hence, lockups differ from defensive measures like “poison pills” that are triggered by a shift of control. Berkovitch and Khana (1990) refer to these defensive measures as value reducing defensive strategies (VRDS). They demonstrate that although these measures may protect and entrench target management, they may also increase shareholder surplus from a takeover.

²“MergerTalk: Corporate break-ups get harder to do” *Reuters*: April 18, 2003.

³A non-foreclosing bid, described below, is one that does not terminate the takeover contest. Apparently, the lone objection to the Ayres’ theorem comes from Coates and Subramanian (2000) based on heuristic and empirical arguments.

⁴Bidders incur substantial costs evaluating the target’s assets, and financing and preparing a takeover bid.

hand, offering a lockup to a bidder may reduce a non-recipient bidder's chance of winning and thereby discourage his participation. This reduces competition for the target, which may be socially undesirable.

While existing legal studies recognize these conflicting effects, the formal analyses they employ are incomplete in several respects. First, most of the extant literature does not explicitly model the bidder's participation decision, although this is crucial for understanding the subsidizing/foreclosing effects of lockups mentioned above. Second, the prior analyses of bidding competition typically presume buyers are perfectly informed of each others' valuations. While this is a useful simplification, it is clearly unrealistic and may generate misleading results. For instance, as we demonstrate below, Ayres' irrelevance theorem and the Coase theorem do not generalize when bidders are privately informed of their valuations for the target.⁵ Third, the extant studies do not distinguish between different types of lockup measures. Interestingly, this sharply contrasts with the attitude of courts which have been much more lenient towards breakup fees than stock lockups.⁶ Given the importance of the case law, the courts' asymmetric treatment of stock lockups warrants a careful comparison of the two different measures. Fourth, the existing literature fails to distinguish adequately between shareholder interests and social welfare. The primary focus of the literature has been maximization of the shareholder interest, although it need not coincide with the social objective. As we demonstrate below, some lockup measures increase shareholder revenue but reduce social surplus by inducing too much or too little competition for the target.

In this paper, we distinguish between the effects of breakup fees and stock lockups on the

Once one bids, rival buyers learn of the takeover and enter the competition for the target. This reduces the return from target acquisition and has a chilling effect on the takeover. Lockups reduce a buyer's risk from takeover, by increasing the return from acquisition and thereby leading to greater competition in the market for corporate control.

⁵Fraidin and Hanson (1996) base its permissive view of lockups largely on the Coase theorem, which implies that bargaining continues until the efficient allocation is achieved. Asymmetric information introduces a form of transaction costs which undermines the central force of the Coase theorem.

⁶The precedence setting event was *Paramount Communications Inc. v. QVC Network Inc.* amid the former's merger agreement with Viacom, which included both breakup fees and stock lockups. The Delaware Chancery court enjoined stock lockups but upheld the breakup fees. On the appeal by QVC, but not on the breakup fee component, the Delaware Supreme court was critical on both but more on the stock lockup. The courts' differential treatment of the two instruments was influenced by several unusual features of the case such as relatively small size of the breakup fee and no caps on the size of stock lockup. Nonetheless, the treatment led to the relative decrease in the use of stock lockups (see Coates and Subramanian, 2000).

social efficiency of takeover and the welfare of target shareholders. Further, we study the effects of lockups in different stages of the takeover contest by analyzing their impact on bidder participation over time. We confirm that lockups may induce a first bidder to put the target in play by compensating that bidder for identifying the target as a viable takeover prospect to the market. We also find that lockups may likewise induce second bidders to compete for the target.⁷ Without any subsidy, a second buyer may not compete against a better informed first bidder who offers a preemptively high initial bid. The target can counteract the preemptive bid by subsidizing the second bidder through a lockup. The possibility of such a lockup in turn reduces the first bidder's incentive for preemptive bidding.

In what follows, we primarily focus on the faithful target board of directors who employ lockup policies to maximize shareholder value from takeover. This approach yields a reasonable first-cut analysis of the role of lockups and serves to highlight how the pursuit of shareholder interest may deviate from that of social welfare maximization. We later consider the possibility that an unfaithful management/board may misuse lockups to manipulate the takeover outcome for their private benefit, and examine the susceptibility of the alternative lockup provisions to such misuse.

Our central findings are summarized as:

- *Non-equivalence of lockup provisions:* Contrary to conventional wisdom and Ayres' irrelevance theorem, breakup fees and stock lockups have distinct effects on corporate takeover. Breakup fees are non-distortionary and provide for the target to be acquired by the highest valued buyer in a bidding contest. In contrast, stock lockups distort the bidding process, sometimes permitting a lower valued buyer to acquire the target.
- *Breakup fees may implement socially efficient takeover:* When all lockup measures are prohibited, there is insufficient participation of potential buyers in takeover contests. The first bidder is inadequately rewarded for its search effort that reveals valuable information about the target to subsequent bidders. Second bidders are deterred from entering the takeover contest too frequently by a preemptory first buyer bid. Lockups enable target management to subsidize the entry of bidders. The regulatory rule that permits only

⁷Targets often employ a lockup to recruit a second bidder in response to, or in anticipation of, an initial takeover bid. In the famed Revlon takeover case, Revlon's offer of lockup to Forstmann Little and Co. was a response to an initial takeover bid by the Pantry Pride, Inc. Similarly, the Warner-Lambert Company offered lockup provisions to the American Home Products in anticipation of a hostile takeover attempt by the Pfizer.

breakup fees dominates the prohibition of all forms of lockups. In plausible circumstances, the breakup fees implement socially efficient takeover, by inducing the socially desired degree of initial bidder preemption.

- *Stock lockups may induce too much or too little competition:* Stock lockups shift rents away from the non-recipient to the recipient buyer, allowing the target to subsidize the recipient buyer at the expense of the other bidder. Consequently, when stock lockups are used to stimulate second buyer bidding they induce excess competition, and when they are employed to subsidize first buyers they induce too little competition.
- *Targets prefer stock lockups:* Despite their socially wasteful properties, the target management would favor stock lockups, as they subsidize recipients' bidding at the expense of non-recipients.⁸

The remainder of the paper begins with Section 2 which examines the effect of lockups on bidding competition. Section 3 models and analyzes the sequential participation of bidders in takeover contests. *Section 4 discusses some extensions of the analysis to setting where there are more than two potential bidders, the cost of bidding is private information and lockups are susceptible to misuse by unfaithful target management. Section 5 concludes.*

2 The effects of lockups on bidding competition

This section describes how alternative lockup measures affect competitions once bidding begins. In the process, we reevaluate Ayres' irrelevance theorem when bidders are privately informed. While the results derived here are of independent interest, they also form a basis for the analysis of section 3, which considers the effects of lockups on sequential participation of bidders.

To begin, consider two buyers, 1 and 2, competing to acquire the target firm, T . Our focus on the two bidder case here and in the next section simplifies matters and it seems appropriate given few takeovers involve more than two bidders.⁹ The target value under the existing management

⁸Stock lockups are preferred by target management from among the set of lockup measures commonly employed in practice. Other processes such as discriminatory auctions with pre set reserve prices could produce even greater surplus for the Target in theory. That such auctions aren't used in practice suggests they might be illegal or difficult to implement.

⁹For instance Bradley et. al. (1988) report in their study of takeover contests that the vast majority of multiple bidder acquisition involves just two buyers.

is normalized to zero.¹⁰ Buyer $i = 1, 2$'s target valuation, v_i , is distributed over $V_i := [\underline{v}_i, \bar{v}_i]$, with $\underline{v}_i \geq 0$, according to a cdf $F_i(\cdot)$ which has positive density, $f_i(v)$, for $v \in (\underline{v}_i, \bar{v}_i)$.¹¹ We assume the inverse hazard rate, $h_i(v) := (1 - F_i(v))/f_i(v)$, is decreasing in $v \in V_i$.¹² Bidder i 's private valuation v_i is unknown to both the target and the rival bidder, who know only that v_i is distributed by $f_i(v)$. The bidders' participation decisions preceding the competition may well have led the parties to update their information. In this sense, F_i may be interpreted as the updated posterior distribution formed at the beginning of the auction. The process whereby bidders update their information based on their rival's decision to participate is considered in section 3.

We model the bidding competition as an ascending bid "clock" auction, in which the price rises continuously and the last remaining bidder wins and pays the last exit price.¹³ Our model mimics a formal auction proposed by the courts and legal analysts for takeover,¹⁴ but it is also a reasonable depiction of the sequential negotiation/bidding arising among rival buyers. In our model, bidder $i = 1, 2$'s strategy specifies the critical price, $b_i(v)$, as a function of his valuation, at which he plans to exit, given that his opponent still remains in the competition. We assume

¹⁰For tractability we abstract from the possibility that the target has private information regarding its acquisition value for a prospective buyer. See Fishman (1989) for an analysis of preemptive bidding and takeover in such a setting.

¹¹Buyers' valuations vary because of the different synergies they realize from acquiring the target's assets. Synergies created by the merging of the target with a prospective buyer vary according to the increase in market share, strategic benefit, utilization of technology and corporate knowledge and the combining of complementary assets arising from the merging of different corporations.

¹²We extend the definition by letting $h_i(v) := \infty$ for $v < \underline{v}_i$ and $h_i(v) := 0$ for $v > \bar{v}_i$.

¹³This implicitly assumes that the target is always transferred to the highest bidder. This assumption simplifies the analysis of takeover auctions. However our qualitative results apply as well to cases in which the target sets a reservation price sufficiently high, so that takeover is precluded when bidders valuations are small. Here we assume that \underline{v}_i is sufficiently large so that it is revenue maximizing for the target to be acquired by one of the buyers.

¹⁴In some jurisdictions, most notably, Delaware, target management is required by law to behave as an auctioneer would to solicit the highest tender price. For instance, the Delaware Courts which oversee the vast majority of takeovers in the United States have ruled that 'in a sale of corporate control the responsibility of directors is to get the highest value reasonably attainable for shareholder. Further the directors' role is to behave as auctioneers charged with getting the best price for the stockholders at a sale of the Company.' These passages are paraphrased from Mills Acquisition Co.v. Macmillan Inc., 559 A.2d 1261, 1288 (Del. 1989) and from Revlon Inc. v. MacAndrews & Forbes Holdings, Inc. 506 A.2d 173 182 (Del 1986). The choice of auctions over individual negotiation is also supported by legal and institutional considerations (Bebchuk (1982), and Gilson (1982)) and by economic theory (see Cramton and Schwartz (1991) and Bulow and Klemperer (1996)).

the winning bidder is able to exit instantaneously at the losing bidder's price.¹⁵ We focus on a Bayesian Nash equilibrium in weakly undominated strategies. We will simply call the pair, $(b_1(\cdot), b_2(\cdot))$, satisfying these properties "equilibrium bidding strategies."

Lockup provisions affect equilibrium bidding strategies and allocation. Suppose bidder $r = 1, 2$ has received an lockup provision consisting of *breakup fee* $\tau \geq 0$ and *stock lockup* with share $\mu_r \in [0, 1]$ for some strike price of v_0 . Total shares of the target are normalized to be one, and μ_r is a fraction of the total shares. In the event the target is sold to buyer $n \neq r$, this lockup arrangement entitles buyer r to a cash payment of τ_r and to purchase μ_r shares at the strike price of v_0 and to resell them at the winning buyer's bid price. Given a fixed strike price the lockup arrangement is summarized by the pair (τ_r, μ_r) . Throughout, we assume the strike price is sufficiently small so $v_0 \leq \underline{v}_i, i = 1, 2$, implying that the recipient always wishes to exercise the option. Further the lockup benefit is capped with $\tau_r \leq \underline{v}_n + \mu_r v_0$, for $r, n = 1, 2$. While these assumptions are made to simplify the analysis, they do not affect our qualitative results. Further, the assumptions are plausible in the takeover settings. Typically the strike price is very low, and the value of total shares offered for lockup constitutes a small percentage of the merger price, perhaps to avoid the court's scrutiny of the lockup provision.¹⁶

For $i = 1, 2$, let

$P_i(b_i)$ = total payment bidder i makes to the target (and to bidder $j \neq i$) if bidder i wins

the auction with a bid of b_i .

$L_i(b_j)$ = surplus bidder i receives when losing to buyer j with a bid of b_j .

The effect of a lockup provision (τ_r, μ_r) is then summarized as follows.

Table 1: The effect of lockup

¹⁵This "clock stopping feature" can then be seen as an endogenous tie-breaking rule that allows for existence of an equilibrium.

¹⁶If strike prices are not low enough, then the recipient may simply choose not to exercise the option when his valuation is sufficiently low. If $\tau_r > \underline{v}_n + \mu_r v_0$, then the non-recipient may not participate when he has sufficiently low valuations. This will increase the foreclosing effect of lockups. As will be clear, this is never in direct interest of the target. Further, the possibility of exclusion due to this effect does not appear to affect the comparison of the alternative lockup measures, which is the focus of the current paper.

	No Lockup	Lockup with (τ, μ, v_0)
$P_r(b_r)$	b_r	b_r
$L_r(b_n)$	0	$\tau_r + \mu_r(b_n - v_0)$
$P_n(b_n)$	b_n	$b_n + \tau_r + \mu_r(b_n - v_0)$
$L_n(b_r)$	0	0

Given the lockup provision (τ_r, μ_r) , the recipient simply pays his bid, b_r , if he wins. If he loses, he receives the breakup fee τ_r and the profit from exercising his stock option, $\mu_r(b_n - v_0)$. Recall that the losing bidder's bid, i.e., his exit price, becomes the price the winner pays, so each exercised share yields a profit equalling the difference between the losing recipient's bid and the strike price. By contrast, the non-recipient bidder receives zero when he loses, and when he wins, he pays $\tau_r + \mu_r(b_n - v_0)$ plus his bid b_n .¹⁷¹⁸

The equilibrium bidding strategies can be characterized for an arbitrary lockup provision, (τ_r, μ_r) , as follows. Suppose $b_j(\cdot)$ induces a cdf $G_j(\cdot)$ of buyer j 's bid. Then, for any v_i , $b_i(\cdot)$, $i \neq j$, must satisfy

$$b_i(v_i) \in \arg \max_{b_i} \pi_i(b_i; v_i) := \int_0^{b_i} (v_i - P_i(\tilde{b})) dG_j(\tilde{b}) + (1 - G_j(b_i)) L_i(b_i). \quad (1)$$

As we demonstrate below, stock lockups and breakups induce different strategic responses from bidders. Hence, we treat them separately, beginning with a case in which only breakup fees are used.

2.1 Breakup fees ($\mu_r = 0$)

It follows from Table 1 that, when $\mu_r = 0$, bidder i 's winning surplus, $v_i - P_i(\tilde{b})$, and losing surplus, $L_i(b_i)$, are independent of his bid, whether he receives a breakup fees or not. Hence, differentiating (1) with respect to b_i gives

$$\frac{\partial \pi_i(b_i; v_i)}{\partial b_i} = ([v_i - P_i(b_i)] - L_i(b_i)) g(b_i)$$

¹⁷Technically, the target makes the lockup payment, but the payment burden is ultimately shifted to the eventual owner of the target.

¹⁸The lockup fees we analyze, restrict the target to offering linear payments. These payments reflect actual provisions that are employed in practice. The effect of allowing non linear payments would be to endow the target with more powerful instruments for controlling takeover. As a result the target could subsidize entry at a lower cost and would therefore generate greater surplus from the sale of its assets. However, to attain maximum surplus, would require the target to extract payments from the buyers prior to becoming informed, which is not possible in practice.

Since $P_i(b_i)$ is nondecreasing in b_i and L_i is constant, the derivative is nonincreasing in b_i . Therefore, buyer i 's payoff is maximized at b_i satisfying $v_i - P_i(b_i) = L_i(b_i)$, or at $b_i^B(v_i) := v_i - \tau_r$ for $i = 1, 2$. That is, each buyer has a weak dominant strategy of continuing to bid until the price reaches a level at which he is indifferent to winning and losing. These results are summarized as follows.

Proposition 1 *In an ascending bid auction with a breakup fee τ_r offered to buyer $r = 1, 2$, buyer $i = 1, 2$ with valuation v_i bids*

$$b^B(v_i) = v_i - \tau_r,$$

and the target is allocated efficiently.

A breakup fee causes each buyer to bid below his value by the amount of the fee. This is because the net value of acquiring the target is reduced by τ_r for both buyers, for the non-recipient buyer loses τ when he wins, whereas the recipient would lose τ if he wins. The proposition also indicates that auctions with breakup fees are non-distortionary and efficient, as the highest valued bidder wins the auction.

The payoff consequence of the breakup fee is also quite clear. Let $\pi_i(v_1, v_2; \tau_r, \mu_r)$ denote the equilibrium payoff for party $i = 0, 1, 2$ from the ascending bid auction, when buyers 1 and 2 have (v_1, v_2) and buyer r has a lockup package of (τ_r, μ_r) . The case of no lockup is obtained simply as corollary of Proposition 1, upon setting $(\tau_r, \mu_r) = (0, 0)$. With a positive breakup fee, the bidders reduce their bids by τ_r , so the allocation remains the same as when no lockup is offered. Hence, the breakup fee acts simply as a lump sum transfer of τ_r from the target to the recipient buyer:

Corollary 1 $\pi_r(v_1, v_2; \tau_r, 0) = \pi_r(v_1, v_2; 0, 0) + \tau_r$, $\pi_n(v_1, v_2; \tau_r, 0) = \pi_n(v_1, v_2; 0, 0)$ and $\pi_0(v_1, v_2; \tau_r, 0) = \pi_0(v_1, v_2; 0, 0) - \tau_r$.

Interestingly, the non-recipient buyer is unharmed by the breakup fee, as he receives the same payoff as if no breakup fee is employed. That breakup fees cannot be used as a method for shifting rents from non-recipient buyer has important implications on the bidder participation decision we analyze in the next section.

2.2 Stock lockups ($\mu_r > 0$)

Like breakup fees, a stock lockup provides its recipient with compensation in the event he fails to acquire the target. This similarity has led many analysts to treat lockups and breakup fees as equivalent. However, the stock lockup creates a new, and previously unrecognized, strategic motive for the recipient buyer, which distinguishes it from breakup fees.

To begin, note that the non-recipient's exit strategy does not affect his relative payoff from winning; it only affects the maximum price for which he will win the target. Hence, as with breakup fees, the non-recipient has a weakly dominant strategy of continuing to bid until the auction price rises to b such that $v_n = P_n(b)$, or

$$b_n^L(v_n) = P_n^{-1}(v_n) = \frac{v_n + \mu v_0 - \tau_r}{1 + \mu_r}, \quad (2)$$

unless buyer r exits before, in which case buyer n exits immediately thereafter.

By contrast, a stock lockup introduces a new strategic motive for the recipient, since his bidding strategy affects his compensation when he loses. The recipient's bid effectively sets the price his rival pays when he loses, so the higher his losing bid is, the more profitable his option becomes. Hence, the recipient has an incentive to continue bidding to raise the winning price in case he loses the auction. Formally, the recipient's losing surplus $L_r(b_r)$ is an increasing function of b_r (unlike breakup fees where losing surplus is independent of b_r). This feature implies the recipient buyer has no weak dominant strategy.

To characterize the recipient's equilibrium strategy, notice that by choosing $b_r(\cdot)$ the bidder is effectively choosing the marginal type of non-recipient to beat, $\phi_n(v_r) := b_n^{L^{-1}}(b_r^L(\cdot))$. Hence, there is no loss in viewing the recipient as directly choosing $\phi_n(v_r)$. We can thus rewrite the equilibrium condition (1) for the recipient as:

$$\phi_n(v_r) \in \arg \max_{\hat{v}_n \in [\underline{v}_n, \bar{v}_n]} \int_{\underline{v}_n}^{\hat{v}_n} (v_r - P_r(b_n^L(v_n))) dF_n(v_n) + (1 - F_n(\hat{v}_n)) L_r(b_n^L(\hat{v}_n)). \quad (3)$$

The objective function in (3) is differentiable and quasi-concave in \hat{v}_n . Hence, buyer r 's equilibrium bidding strategy is characterized by the first-order condition, which upon substituting for $b_n^L(v_n)$ from (2), simplifies to:

$$v_r - \phi_n(v_r) + \left(\frac{\mu_r}{1 + \mu_r} \right) h_n(\phi_n(v_r)) + \lambda_1 - \lambda_2 = 0, \quad (4)$$

where $(\lambda_1, \lambda_2) \geq (0, 0)$ are the Lagrangian multipliers satisfying $\lambda_1(\phi(v_r) - \underline{v}_n) = 0$ and $\lambda_2(\bar{v}_n - \phi(v_r)) = 0$, respectively. The equilibrium is therefore characterized as follows.

Proposition 2 *If $\mu_r > 0$, there exists a unique Bayesian Nash equilibrium (in undominated strategies) in which the non-recipient buyer with v_n bids*

$$b_n^L(v_n) = \frac{v_n + \mu_r v_0 - \tau_r}{1 + \mu_r},$$

and the recipient buyer with v_r bids

$$b_r^L(v_r) = \begin{cases} \frac{\underline{v}_n + \mu_r v_0 - \tau_r}{1 + \mu_r} & \text{for } v_r \leq \phi_r^L(\underline{v}_n), \\ \frac{\phi_n^L(v_r) + \mu_r v_0 - \tau_r}{1 + \mu_r} & \text{for } v_r \in [\phi_r^L(\underline{v}_n), \phi_r^L(\bar{v}_n)], \\ \frac{\bar{v}_n + \mu_r v_0 - \tau_r}{1 + \mu_r} & \text{for } v_r \geq \phi_r^L(\bar{v}_n), \end{cases}$$

where $\phi_r^L(v_n) = v_n - (\frac{\mu_r}{1+\mu_r})h_n(v_n)$ and $\phi_n^L(v) = \phi_r^{L-1}(v)$. The target is inefficiently sold to the recipient with positive probability, if $\underline{v}_r < \bar{v}_n$ and $\bar{v}_r > \underline{v}_n - (\frac{\mu_r}{1+\mu_r})h_n(\underline{v}_n)$.

A stock lockup causes the non-recipient buyer to bid lower than his value. His incentive to acquire the target is diminished because he must compensate the recipient with stock lockup benefits if he wins the auction. Thus, stock lockups are similar to breakup fees in this respect. Stock lockups differ from breakup fees in one important respect, however. Since the recipient's losing compensation, $L_r(b)$, increases with the non-recipient's winning bid, the recipient is motivated to bid more aggressively than his rival. This causes the recipient to win sometimes when her rival places greater value on the target, thus resulting in an allocative distortion. In particular, the recipient bidder never exits strictly before the lowest type of non-recipient does, which results in the non-recipient with \underline{v}_n earning zero payoff even when $\underline{v}_n > \underline{v}_r$. In fact, the recipient bids more than his value when his valuation is low: given his slim chance of winning, he simply raises his bid to force the non-recipient to pay greater lockup compensation when he loses.¹⁹ Importantly, these two features imply that, unlike breakup fees, stock lockups shift rents from the non-recipient to the recipient:

Corollary 2 *Suppose that $\mu_r > 0$ and that $\underline{v}_r < \bar{v}_n$. Then, $\pi_n(v_1, v_2; \tau_r, \mu_r) \leq \pi_n(v_1, v_2; 0, 0)$ and $\pi_0(v_1, v_2; \tau_r, \mu_r) + \pi_r(v_1, v_2; \tau_r, \mu_r) \geq \pi_0(v_1, v_2; 0, 0) + \pi_r(v_1, v_2; 0, 0)$ for all (v_1, v_2) , and the inequalities are strict for a set of (v_1, v_2) arising with positive probability. Further,*

$$\mathbb{E}_{v_n}[\pi_r(v_1, v_2; \tau_r, \mu_r)] \geq \mathbb{E}_{v_n}[\pi_r(v_1, v_2; 0, 0)] \text{ for all } v_r.$$

¹⁹This finding runs counter to some court rulings which disallow stock lockups based on the argument that lockups induce buyers to bid less, when a buyer may benefit from losing. See Fraidin and Hanson (1996, pages 1761-2).

Proof. See the appendix.

As the corollary suggests, a stock lockup compensates the recipient *at the expense of* the non-recipient. This will be seen to have important implications for the target's choice of lockups in inducing bidders to participate in the takeover contest.

2.3 The effect of lockups on the target

How do lockups affect the surplus generated when a takeover auction occurs? Can the target increase shareholder revenue by favoring one of the buyers with a lockup? If so, what mix of lockup instruments will it prefer to use? What is the social welfare consequence of, and the regulatory implication for, lockups in general? We now address these questions, assuming that the buyers always bid to acquire the target, or equivalently, bidder participation entails no cost. Although the assumption of zero bidding cost is unrealistic, it enables us to isolate the effect of lockups on bidder competition. This case will also serve as a useful benchmark for our analysis in the next section which will introduce nontrivial bidding costs.

The target's lockup choice depends on the legal regime it operates under. Throughout, we consider three legal regimes: (1) **Regime N**: the target is not allowed to offer any lockup provision; (2) **Regime B**: the target may offer only breakup fees; and (3) **Regime L**: the target may offer breakup fees and stock lockups. Henceforth, we denote legal regimes by superscript $k = N, B, L$. Our findings on the impact of lockups on bidder competition are summarized as follows.

Proposition 3 *Suppose that both buyers always participate in the auction.*

(a) *In regime B, the target will not offer a breakup fee to either buyer, and the target is allocated efficiently.*

(b) *In regime L, if the buyers are symmetric with $F_1(v) = F_2(v)$ for all v , then the target will not offer any lockup to either buyer, in which case the allocation is efficient. If $h_i(v) \leq h_j(v)$ for all v and $h_i(v) < h_j(v)$ for a positive measure of v , for $i, j = 1, 2$, then the target never offers a lockup to buyer j but it offers a stock lockup to buyer $i = 1, 2$. The target allocation is then distorted toward the recipient.*

Proof. See Appendix.

Part (a) follows directly from Corollary 1, which implies that a breakup fee transfers resources away from the target. Part (b) is a corollary of Myerson's (1981) optimal auction design result,

which suggests that handicapping (i.e., distorting allocation against) a bidder is optimal for the auctioneer if the bidders are asymmetric (in the sense of the assumed hazard rate ranking) but suboptimal if the bidders are symmetric. As we demonstrated in Proposition 2, a stock lockup has the effect of handicapping the non-recipient bidder. Hence, the target does not benefit from stock lockups unless the bidders are asymmetric.

Since handicapping induces inefficient takeover, the appropriate regulatory response would be to permit only breakup fees. However, this conclusion presumes that buyer participation in takeover is costless. We now turn to the issue of how lockup provision can be employed to induce buyers with positive bidding costs to compete for the target.

3 Lockup effects on bidder participation

To model the effects of lockups on bidder participation, two important features of the corporate takeover must be incorporated. First, preparing and initiating a takeover bid requires a substantial sunk investment for the prospective buyer. The investments are needed for identifying and learning about the value of the target, and also include expenses for hiring lawyers and the opportunity cost of cancelling or delaying the acquisition of another prospect while the buyer bids for the target. Indeed, initial costs are often large, as the transactions costs of arranging for financing and specifying an opening bid alone may equal several million dollars, often sufficient to deter potential buyers from bidding for the target. Second, the bidder participation is sequential, with one firm often initiating a bid to put the target in play, followed by subsequent competition by another buyer. The sequential nature of bidder participation creates two strategic problems. First, there may be informational externalities associated with the initial bidder's search investment, since the initial bid may reveal the common component of the buyers' valuations which later buyers may free ride on. This means the first bidder may be under-rewarded for his investment. Second, as first recognized by Fishman (1988), the first bidder may wish to preempt the subsequent bidder by credibly signaling that he has a sufficiently high valuation. Such preemption may stifle competition to the detriment of target shareholders. These two effects of sequential bidding, combined with substantial entry costs, suggests that lockups may either be used as a subsidy to compensate the first bidder for the informational externalities he provides, or to induce second bidder participation as a counter to preemptive bidding by the first buyer.

3.1 A model of sequential bidder participation

To proceed, we consider the following simple extension of our basic model. Again, there are two buyers with own zero shares of the target. Buyer i 's valuation of the firm is $\theta_i = qv_i$, where $q \in \{0, 1\}$ is the common value component, and v_i is buyer i 's private valuation of the firm. The private values are independently and identically distributed by a cdf $F(v_i)$ with strictly positive density, $f(v_i)$, for $v_i \in V \equiv [\underline{v}, \bar{v}]$. Requiring private values to be symmetrically distributed helps to reduce notation and simplify the analysis, though it is not required for most of our results.²⁰ As before, the inverse hazard rate, $h(v) := (1 - F(v))/f(v)$ is assumed to be strictly decreasing in $v \in V$. The value of the firm under current management is again zero. Clearly, takeover is *valuable* only if $q = 1$ which arises with probability $\lambda \in [0, 1]$. The presence of the common value component creates the potential for informational externalities mentioned above.

To initiate a bid, buyer $i = 1, 2$ must incur a sunk cost of $c_i > 0$ to learn about target value and prepare a bid. Subsequent bids are tendered at no additional cost.²¹ It is the presence of bidder participation cost, along with the sequential nature of bidder participation, that renders a lockup a valuation instrument for managing takeover competition.

The sequence of events follows the sequential takeover model of Fishman (1988), as described in Figure 1.²²

[Insert Figure 1 about here.]

First, buyer 1 (henceforth B1) decides whether to invest c_1 to determine the target value. If he invests, he learns the value qv_1 . He can then initiate a bid no less than zero (the target value under the current management).²³ If he does not bid, the takeover process stops and the game ends as the second buyer infers the target value is zero. If B1 does bid, and the target accepts, takeover occurs at B1's bid price. If the target (henceforth T) rejects the bid then buyer 2 (henceforth B2) decides whether to invest c_2 and compete for the target. If B2 fails to bid,

²⁰In particular, the optimality of breakup fees does not depend on the symmetry. Symmetry matters only in regime L, where it eliminates the need for a stock lockup as a handicapping device, noted in Proposition 3-(b).

²¹See Daniel and Hirshleifer (1993, 1995) for an interesting analysis of takeover bidding when rebidding is costly.

²²See also Berkovitch and Khanna (1990), Bulow, Huang and Klemperer (1999) and Singh (1998) for a similar model in their analyses of toeholds. These studies do not consider lockups.

²³In other words, the target firm cannot credibly demand an initial bid exceeding the market price of the firm. We are thus assuming that management has limited ability to commit to a profit maximizing takeover process. Management must entertain all qualified offers to acquire the target and will sell to the highest bidder with an offer above the existing value of the firm. Any management behaving differently can be seen as violating its fiduciary duty shareholders.

then B1 acquires T at a zero bid (i.e., the market price of T). If B2 bids, the ascending auction between B1 and B2 proceeds as described in the previous section. All sales are final and all shareholders tender their shares at the winning bid price. Bidders are not allowed to withdraw a winning bid, or to renegotiate with the target or the other buyer for the resale of T.

Unlike Fishman (1988), our objective is to analyze the role of lockups as an entry subsidy. We assume lockups may be offered immediately prior to each buyer making his investment decision. T may offer B1 a lockup prior to his investment decision, or it may offer B2 a lockup prior to his investment if it has not offered B1 a lockup before. We assume, as is the practice, that the target is not permitted to offer lockups to multiple buyers simultaneously. Multi-party lockups constitute a conflict of interest for the target and bidders, so they are unlikely to be enforceable.

In what follows, we analyze the effects of lockups on the buyers' participation decisions under the legal regimes $j = N, B, L$, assuming as before that the target shareholders are collectively represented by faithful board/management acting on their behalf.

In each regime, B1 may preempt by signaling his value to the subsequent bidder. As is well known, signaling games typically have many equilibria. Following Fishman (1988), we focus on the Perfect Bayesian equilibrium involving the most profitable outcome for B1. This equilibrium selection is formally justified by Grossman and Perry (1986)'s *credible belief* refinement.²⁴

3.2 Benchmark: socially efficient takeover

Before proceeding, it is instructive to characterize the socially efficient takeover behavior. Efficient takeover requires three conditions. First, the target must be allocated to the buyer with highest value, conditional on both buyers having entered into competition. Second, B2 should only enter into competition if the resulting expected increase in social surplus exceeds his entry cost, c_2 . The net social gain from B2's entry, given B1's value is $v_1 = \hat{v}$, is given by

$$\Gamma^*(\hat{v}) = \mathbb{E}[\max\{v_2 - \hat{v}, 0\}] - c_2 \quad (5)$$

The function $\Gamma^*(\hat{v})$ is strictly decreasing in $\hat{v} \in (\underline{v}, \bar{v})$. In what follows, we focus on the interesting case in which $\Gamma^*(\underline{v}) > 0 > \Gamma^*(\bar{v})$, so that there exists a socially efficient threshold type \hat{v}^* satisfying $\Gamma^*(\hat{v}^*) = 0$. The second requirement is that B2 should enter if and only if $v_1 < \hat{v}^*$. Finally, B1's entry should be socially efficient, assuming subsequent efficient behavior. The net

²⁴The credible belief requirement of Grossman and Perry (1986) restricts T's and B2's beliefs about which type of B1 bidders would have selected a bid that is off the equilibrium path.

social gain from B1's entry is

$$W^* = (\hat{v}^*) := \lambda \left\{ \int_{\underline{v}}^{\bar{v}} v_1 dF(v_1) + \int_{\underline{v}}^{\hat{v}^*} \Gamma^*(v_1) dF(v_1) \right\} - c_1, \quad (6)$$

which reflects takeover occurring only if $q = 1$. The third requirement is then B1 should enter if and only if $W^* \geq 0$. To focus on a nontrivial case, we assume throughout $W^* \geq 0$. Given this assumption, a *socially efficient takeover outcome* requires B1 should always enter, B2 should enter if and only if $v_1 < \hat{v}^*$, and the target is allocated to the highest valued buyer among those who have entered.

As will be seen shortly, socially efficient takeover is unlikely to occur unless bidders are somehow subsidized to overcome informational externalities and the preemption by the initial bidder. This outcome would be even difficult for government regulators to implement as they would be required to know the bidders' target valuations. Remarkably, we find the socially efficient outcome can be implemented under a plausible circumstance if the target is simply restricted to employing breakup fees.

In the next two subsections, we consider in turn instances in which the second bidder is offered a lockup and ones in which the first bidder is offered a lockup. The last subsection analyzes the social and private implications of alternative legal regimes.

3.3 Second-bidder lockups

Consider the subgame in which B1 invests c_1 without receiving a lockup from the target. Of special interest is how the target may use a lockup to induce B2's entry and how that affects B1's bidding behavior.

Proceeding as in Fishman (1988) for a given legal regime $j = N, B, L$, we look for a subgame equilibrium (outcome) of the form: There exists a type $\hat{v}^j \in [\underline{v}, \bar{v}]$ such that B1 makes a preemptive jump bid of $\hat{b}^j > 0$ if $v_1 \geq \hat{v}^j$ and a zero bid if $v_1 < \hat{v}^j$; The target accepts the former and rejects the latter bid. Rejection results in B2 entering without a lockup, triggering an ascending auction. (The possibility B1 never preempts regardless of v_1 is incorporated in this characterization with $\hat{v}^j \equiv \bar{v}$.) Below, we invoke necessary conditions for equilibrium to pin down \hat{v}^j and \hat{b}^j , and to establish that an equilibrium of this form exists. In so doing, we focus on the case with $\hat{v}^j < \bar{v}$; i.e., preemption occurs with positive probability in equilibrium. If no equilibrium can satisfy this condition, then preemption never occurs in equilibrium.

Suppose first that B1 makes a non-preemptive bid. This implies the updated distribution of B1's type becomes $F_1(v) = \min\{F(v)/F(\hat{v}^j), 1\}$ for $v \in \mathbb{R}_+$ while the distribution of B2's type remains unupdated at $F_2(\cdot) = F(\cdot)$. Observe for $v \in [v, \hat{v}^j]$, $h_1(v) = \frac{F(\hat{v}^j) - F(v)}{f(v)} \leq h(v) = h_2(v)$. Hence, by Proposition 3-(b), the T will never offer B2 a lockup even in regime L, just as in the presumed candidate equilibrium. The ensuing ascending auction will then play out just as described in Proposition 1 with $\tau = 0$. Consequently, if the threshold type \hat{v}^j were to make a non-preemptive bid, then it would receive $\mathbb{E}[\max\{\hat{v}^j - v_2, 0\}]$. If that type makes a preemptive bid \hat{b}^j instead, then its payoff would be $\hat{v}^j - \hat{b}^j$. In equilibrium, these two payoffs must coincide as the threshold type must be indifferent to preempting and competing in the auction.²⁵ Hence, letting

$$\hat{b}(\hat{v}) := \hat{v} - \mathbb{E}[\max\{\hat{v} - v_2, 0\}] = \mathbb{E}[\min\{\hat{v}, v_2\}],$$

in equilibrium we must have

$$\hat{b}^j = \hat{b}(\hat{v}^j). \quad (7)$$

Suppose next that $\hat{v}^j = \hat{v}$ and that B1 makes a preemptive bid of $\hat{b}^j = \hat{b}(\hat{v})$. The target then decides whether to accept or reject it based on updated beliefs, $F_1(v) = \max\{\{[F(v) - F(\hat{v})]/[1 - F(\hat{v})]\}, 0\}$ and $F_2(\cdot) = F(\cdot)$. Of course, his decision will depend on the continuation play that would follow if he rejects the bid. Let $\Pi_i(\tau_2, \mu_2 \mid \hat{v}) := \mathbb{E}[\pi_i(v_1, v_2; \tau_2, \mu_2) \mid v_1 \geq \hat{v}]$ denote the equilibrium payoff of party $i = 0, 1, 2$ from an ascending auction game where B2 receives a lockup of (τ_2, μ_2) and the posterior is given by $(F_1(\cdot), F_2(\cdot))$. Then, the target's benefit from rejecting $\hat{b}(\hat{v})$ in regime j , $\Gamma^j(\hat{v})$, is described as follows.

In regime N, the target cannot subsidize entry, so B2 will enter if his payoff $\Pi_2(0, 0 \mid \hat{v})$ exceeds entry cost c_2 . If B2 enters, then T receives $\Pi_0(0, 0 \mid \hat{v})$. Otherwise, T receives the minimum bid of zero from B1. Hence, the net benefit from rejecting $\hat{b}(\hat{v})$ is

$$\Gamma^N(\hat{v}) = \begin{cases} \Pi_0(0, 0 \mid \hat{v}) - \hat{b}(\hat{v}) & \text{if } \Pi_2(0, 0 \mid \hat{v}) \geq c_2, \\ 0 & \text{otherwise.} \end{cases}$$

In regimes B and L, T may subsidize B2 with a lockup, so the net benefit from rejecting $\hat{b}(\hat{v})$ is the highest payoff T realizes, net of $\hat{b}(\hat{v})$, subject to inducing B2 to enter:

$$\Gamma^j(\hat{v}) = \begin{cases} \max_{\tau_2} \{\Pi_0(\tau_2, 0 \mid \hat{v}) - \hat{b}(\hat{v}) \text{ s.t. } \Pi_2(\tau_2, 0 \mid \hat{v}) \geq c_2\} & \text{if } j = B, \\ \max_{\tau_2, \mu_2} \{\Pi_0(\tau_2, \mu_2 \mid \hat{v}) - \hat{b}(\hat{v}) \text{ s.t. } \Pi_2(\tau_2, \mu_2 \mid \hat{v}) \geq c_2\} & \text{if } j = L. \end{cases}$$

²⁵ Clearly, the latter payoff must be no less than the former since the type \hat{v}^j is presumed to bid \hat{b}^j ; if the latter payoff exceed the former, however, a type slightly less than \hat{v}^j will wish to preempt, which contradicts the fact that \hat{v}^j is the threshold type.

In the presumed equilibrium with threshold value \hat{v}^j , the target must always accept the bid $\hat{b}^j = \hat{b}(\hat{v}^j)$, which requires $\Gamma^j(\hat{v}^j) \leq 0$. In particular, for the most profitable signaling equilibrium, \hat{v}^j is the smallest type for which T accepts the bid, or

$$\hat{v}^j = \inf\{\hat{v} \mid \Gamma^j(\hat{v}) \leq 0\}, \quad (8)$$

whenever the set is nonempty. (If the set is empty, then preemption never occurs.) We now demonstrate that (7) and (8) are necessary and sufficient for the most profitable signaling equilibrium.

Lemma 1 *Fix a legal regime $j = N, B, L$. In the subgame following B1's investment and realization of $q = 1$, there exists a perfect Bayesian equilibrium with most profitable signaling for B1, with the following properties:*

(i) *If $\Gamma^j(\hat{v}) > 0$ for all $\hat{v} \in [\underline{v}, \bar{v}]$, then B1 bids zero regardless of his type, T rejects the bid and does not offer a lockup to B2, who enters and triggers an ascending auction that allocates the target to the highest valued bidder.*

(ii) *If $\Gamma^j(\hat{v}) = 0$ for some $\hat{v} \in [\underline{v}, \bar{v}]$, then B1 bids zero if $v_1 \in [\underline{v}, \hat{v}^j)$ and $\hat{b}^j(\hat{v}_i)$ if $v_1 \in [\hat{v}^j, \bar{v}]$, where \hat{v}^j and \hat{b}^j satisfy (8) and (7). T accepts \hat{b}^j and rejects the zero bid whereupon B2 enters without a lockup and triggers an ascending bid auction, that allocates the target to the highest valued bidder.*

In each regime, either B1 preempts and acquires the target outright, or an auction without lockups arises and allocates the target efficiently. In either case, lockups are never employed on the equilibrium path. This does not imply that lockups have no impact on the subgame outcome. Rather, it is the ability of T to offer lockups in each regime that determines the likelihood of preemption, as indexed by \hat{v}^j ; the ability to offer lockups affects the target's out-of-equilibrium threat to defeat B1's preemptive bidding.

Clearly preemption is socially desirable when v_1 is sufficiently large, since B2's entry is costly and his value v_2 is unlikely to exceed v_1 . We now characterize the degrees of preemption arising in alternative legal regimes and compare them against the efficient preemption level.

Proposition 4 *$\hat{v}^N < \hat{v}^B = \hat{v}^* < \hat{v}^L$. That is, equilibrium preemption by B1 is socially efficient if the target may only offer breakup fees, whereas there is too much preemption if the target is prohibited from any lockups, and too little preemption if the target is allowed to offer stock lockups.*

Proof. See the Appendix.

To gain more intuition, consider regime N first. In this regime, T's benefit from competition, $\Pi_0(0, 0|\hat{v}) = \mathbb{E}[\min\{v_1, v_2\}|v_1 \geq \hat{v}]$, exceeds B1's preemptive bid, $\hat{b}(\hat{v}) = \mathbb{E}[\min\{\hat{v}, v_2\}]$, so the target prefers to reject B1's preemptive bid whenever B2 would enter without a lockup. This also means that, in regime $j = B, L$, the target will wish to offer a lockup to subsidize B2's entry whenever he would not enter on his own. Consequently, preemption will be less likely in regimes B and L, compared with regime N.

In regimes B and L, B2's lockup will be just sufficient to allow B2 to break even after entry. This will enable T to extract all of the joint surplus of the target and B2. T will therefore induce B2's entry with a lockup whenever it is jointly profitable for T and B2. As noted in Corollaries 1 and 2, a breakup fee subsidizes the recipient without harming the non-recipient whereas a stock lockup shifts rents to its recipient from the non-recipient. This rent-shifting feature of a stock lockup means the cost of subsidizing B2's entry is lower in regime L. Thus the target will be more strongly motivated to induce entry in regime L, resulting in a less preemption in that regime, than in regime B.

Remarkably, the equilibrium preemption in regime B is socially efficient. To see this, observe that, when B2 enters, T and B2's joint surplus, $\Pi_0(\tau_2, 0|\hat{v}) + \Pi_2(\tau_2, 0|\hat{v}) - c_2$, equals $\mathbb{E}[v_2] - c_2$. (If the target is sold to B2, the joint surplus is v_2 . If it is sold to B1, it will be at the price of $v_2 - \tau_2$ but B1 pays τ_2 to B2, so again the joint surplus is v_2 .) Since, by inducing B2 to enter, the target will have to forego the preemptive bid $\hat{b}(\hat{v}) = \mathbb{E}[\min\{\hat{v}, v_2\}]$, its net gain from rejecting the latter bid is

$$\Gamma^B(\hat{v}) = \mathbb{E}[v_2] - \mathbb{E}[\min\{\hat{v}, v_2\}] - c_2 = \mathbb{E}[\max\{v_2 - \hat{v}, 0\}] - c_2 = \Gamma^*(\hat{v}). \quad (9)$$

That is, permitting the target to use only breakup fees induces it to internalize the net social benefit from inducing additional competition.

Since the target is efficiently allocated once an auction begins, the social welfare and the parties' equilibrium payoffs realized in the alternative regimes can be compared by inspecting their threshold types.

Corollary 3 *Let U_i^j denote party $i = 0, 1, 2$'s ex ante equilibrium payoff (gross of B1's entry cost) and let W^j denote the associated social welfare, in regime $j = N, B, L$, when B1 initiates takeover without a lockup.*

$$W^B = W^* > \max\{W^N, W^L\}, U_0^L > U_0^B > U_0^N \text{ and } U_1^L < U_1^B < U_1^N.$$

Proof. See the Appendix.

Once B1 submits an initial bid for the target, stock lockups are socially undesirable since they entail excessive entry and wasteful expenditure on bid preparation. Yet, target shareholders prefer them over breakup fees since they induce greater bidding competition. Hence, shareholders' interests diverge from the maximization of social welfare in this instance. This corollary contrasts with current legal theory which does not distinguish between different lockup arrangements based on their social efficiency properties. But this finding is broadly consistent with current legal practice which requires a higher standard of proof for target management to employ stock lockups than breakup fees.

Remark 1 *The efficiency property of breakup fees extends beyond the setting of our model. For instance, the arguments demonstrating the efficiency of breakup fees do not depend on the distribution of the buyers' valuations. (Note that the efficient auction allocation is supported by the use of weak dominant strategies by the buyers and the efficient preemption behavior above clearly does not depend on the distribution of valuations.) Hence, the breakup fees admit socially efficient takeover behavior even when buyers draw valuations from asymmetric distributions.*

Remark 2 *In regimes B and L, lockups are never actually employed in equilibrium.²⁶ Rather, the credible threat of using them deters B1 from preempting when his valuation is not sufficiently high. At first glance, this feature may appear to be consistent with Kahan and Klausner's (1996) claim that second buyers require no subsidies to compete when it is socially desirable for them to bid. Nonetheless, the option for the target to employ breakup fees is necessary for efficient takeover.²⁷*

3.4 First-bidder lockups

The previous subsection considered the setting where B1 initiates takeover without a lockup (i.e., $\tau_1 = \mu_1 = 0$). We now suppose B1 initiates takeover with lockup $(\tau_1, \mu_1) > (0, 0)$. Recall

²⁶In equilibrium, lockups aren't observed, as B1 is certain as to the reactions of T to any offer it makes. However, lockups might be employed in equilibrium if B1 were uncertain about T's reaction to a preemptive bid. In some instances, T might subsidize the entry of B2 against a preemptive bid, if the cost was lower than expected, or if the benefits were greater than expected.

²⁷As with many types of strategic instruments, the perceived benefit of breakup fees is likely to be understated, since it is the option of being able to use them that has real value, not their actual implementation. See the interesting analysis of Berkovitch and Khanna (1990) who demonstrate the deterrence effect of value reducing defensive measures in discouraging peremptory bids.

offering B1 a lockup commits T not to offer B2 a lockup, so $\tau_2 = \mu_2 = 0$.

In regime $j = B, L$, as before, we consider an equilibrium where B1 either makes a preemptive bid of \tilde{b}^j if $v_1 \geq \tilde{v}^j$ or a non-preemptive bid of zero if $v_1 < \tilde{v}^j$. In the latter case, an ascending auction arises, with the beliefs updated to $F_1(\cdot) = \min\{F(\cdot)/F(\tilde{v}^j), 1\}$ and $F_2(\cdot) = F(\cdot)$.

Let $\tilde{U}_i^j(\tau_1, \mu_1)$ and $\tilde{W}(\tau_1, \mu_1)$ denote party $i = 0, 1, 2$'s payoff (gross of B1's entry cost) and ex ante social welfare, respectively, in regime $j = N, B, L$ when B1 initiates takeover with a lockup of (τ_1, μ_1) . Consistent with the previous section, we denote $\tilde{U}^j(0, 0) = U^j$ and $\tilde{W}^j(0, 0) = W^j$ for $j = N, B, L$ and require $\mu_1 = 0$ for $j = N, B$ and $\tau_1 = 0$ for $j = N$.

Now consider regime $j = B, L$ as regime N has been analyzed above. Following previous arguments, in equilibrium, B1 with the threshold type $\tilde{v}^j < \bar{v}$ must be indifferent to preempting, which implies that

$$\mathbb{E}_{v_2}[\pi_1(\tilde{v}^j, v_2; \tau_1, \mu_1)] = \tilde{v}^j - \tilde{b}^j. \quad (10)$$

Furthermore, since B2 cannot be offered a lockup, preemption can succeed if and only if

$$\Pi_2(\tau_1, \mu_1 | \tilde{v}^j) \leq c_2.$$

In the equilibrium with the most profitable signaling for B1, we must have

$$\tilde{v}^j = \inf\{v \in [\underline{v}, \bar{v}] | \Pi_2(\tau_1, \mu_1 | \tilde{v}^j) - c_2 \leq 0\}. \quad (11)$$

As before, the equilibrium is characterized by a pair $(\tilde{v}^j, \tilde{b}^j)$ satisfying (10) and (11).

First consider regime B. Recall from Corollary 1 $\Pi_2(\tau_1, 0 | \tilde{v}) = \Pi_2(0, 0 | \tilde{v})$ for all \tilde{v} . Hence, $\Pi_2(\tau_1, 0 | \tilde{v}) - c_2 > 0$ if and only if $\Gamma^N(\tilde{v}) > 0$, implying that $\tilde{v}^B = \hat{v}^N$. That is, equilibrium preemption following $(\tau_1, 0)$ coincides with that when the target offers no lockup to either buyer. Corollary 1 also implies $\pi_1(\tilde{v}, v_2; \tau_1, 0) = \pi_1(\tilde{v}, v_2; 0, 0) + \tau_1 = \min\{\tilde{v} - v_2, 0\} + \tau_1$ for all \tilde{v}, v_2 . Substituting this into (10), along with the fact $\tilde{v}^B = \hat{v}^N$, reveals $\tilde{b}^B = \hat{b}^N - \tau_1 = \mathbb{E}[\min\{\hat{v}^N, v_2\}] - \tau_1$. Combined with Corollary 1, this implies a breakup fee of τ_1 offered to B1 serves as a lump-sum transfer from the target without changing the allocation of the target, relative to when no lockup is offered to either buyer. This also implies $\tilde{U}_0^B(\tau_1, 0) = U_0^N - \tau_1$ and $\tilde{W}^B(\tau_1, 0) = W^N$.

Now consider regime L. With $\mu_1 > 0$, Corollary 2 implies $\mathbb{E}_{v_2}[\pi_1(\tilde{v}, v_2; \tau_1, \mu_1)] \geq \mathbb{E}_{v_2}[\pi_1(\tilde{v}, v_2; 0, 0)]$ and $\Pi_2(\tau_1, \mu_1 | \tilde{v}) < \Pi_2(0, 0 | \tilde{v})$. Applying these facts to (10) and (11), we conclude

$$\tilde{v}^L < \hat{v}^N \text{ and } \tilde{b}^L < \hat{b}^N.$$

Offering B1 a stock lockup has a greater foreclosing effect on B2 than offering no lockup. It also follows that $\tilde{U}_0^L(\tau_1, \mu_1) < U_0^N$ and $\tilde{W}^L(\tau_1, \mu_1) < W^N$ if $\mu_1 > 0$, as will be demonstrated below.

Lemma 2 *Suppose B1 initiates takeover with $(\tau_1, 0)$, $\tau_1 > 0$. Then, preemption occurs if $v_1 \geq \tilde{v}^B = \hat{v}^N$; otherwise, B2 enters and the target is allocated efficiently, so T receives $U_0^N - \tau_1$, and social welfare equals W^N . Suppose B1 initiates takeover with (τ_1, μ_1) , $\mu_1 > 0$. Then, preemption occurs if $v_1 \geq \tilde{v}^L$ where $\tilde{v}^L < \hat{v}^N$; otherwise, B2 enters and triggers an auction which allocates the target inefficiently in favor of B1. The associated target payoff and welfare level, denoted $\tilde{U}_0^L(\tau_1, \mu_1)$ and $\tilde{W}^L(\tau_1, \mu_1)$, are strictly less than U^N and W^N , respectively.*

Proof. See the Appendix.

Now we are ready to analyze B1's entry decision and the possible lockup T may offer to B1 prior to his entry. Lemma 2 shows that in each regime the target only wishes to offer B1 a lockup to induce his entry. In regime $j = N, B, L$, B1 would receive $\lambda U_1^j - c_1$ from investing c_1 without a lockup. Recall from Corollary 3 that $U_1^L < U_1^B < U_1^N$. The entry decision in each regime will depend on the cost of entry, c_1 , relative to λU_1^j .

Proposition 5 (a) *In regime N, if $c_1 \leq \lambda U_1^N$, then B1 invests and the social welfare realized is $W^N < W^*$. If $c_1 > \lambda U_1^N$, B1 does not invest and takeover never occurs.*

(b) *In regime B, if $c_1 \leq \lambda U_1^B$, then B1 invests without a lockup, and an efficient takeover arises with realized social welfare, $W^B = W^*$. If $\lambda U_1^B < c_1 \leq \lambda \mathbb{E}[v_1]$, then B1 invests with a breakup fee, and the resulting welfare level is W^N . If $c_1 > \lambda \mathbb{E}[v_1]$, then B1 does not invest and takeover never occurs.*

(c) *In regime L, if $c_1 \leq \lambda U_1^L$, B1 invests without a lockup, and the realized welfare level is $W^L < W^*$. If $\lambda U_1^L < c_1 \leq \lambda U_1^N$, B1 invests with an arbitrarily small lockup (of either kind), with resulting welfare $W^N < W^*$. If $\lambda U_1^N < c_1 \leq \Delta^L := \max_{\tau_1, \mu_1} \lambda[\tilde{U}_0^L(\tau_1, \mu_1) + \tilde{U}_1(\tau_1, \mu_1)]$, B1 invests with a lockup of $\mu_1 > 0$, and the social welfare becomes $\tilde{W}^L(c_1) < W^N$. If $c_1 > \Delta^L$, B1 never invests and there is no takeover.*

Proof. See the Appendix.

Proposition 5 suggests that the availability of lockups facilitates initial takeover bidding. In particular, the rent shifting feature of the stock lockup enables T to subsidize B1's entry at

lower cost, so B1's entry can be supported even when its entry cost is substantially high. Since the target does not internalize the benefit B2 would enjoy from B1's investment, whenever B1 is induced to enter, it is socially desirable.

While stock lockups can subsidize the initial takeover bid more effectively than the breakup fees, they tend to generate more distortion in the later stage, entailing too little preemption (in case they are not offered to B1) or too much preemption (in case they are offered to B1). For this reason, regime B is likely to dominate regime L in a broad set of circumstances. In fact, the possibility of a stock lockup being offered to B2 reduces B1's incentive to invest if no lockup is offered to him. For instance, if $\lambda U_1^L < c_1 \leq \lambda U_1^B$, B1 would not invest without a lockup in regime L, although he would invest without a breakup fee in regime B. This problem will disappear if stock lockup can be offered only to the first bidder (and only a breakup fee can be offered to the second bidder), somewhat in the same spirit as Kahan and Klausner (1996). We label such a legal regime L'. Permitting stock lockups only for the first bidder need not be desirable, however, due to the allocative distortion and increased likelihood of preemption against the second bidder. We conclude our formal analysis below with a comparison of welfare in different regimes.

3.5 Comparing regimes

The equilibrium welfare levels attainable under alternative legal regimes implied by Proposition 5 are described in the following table.

Table 2: Welfare Consequences of Alternative Legal Regimes

	$c_1 \leq \lambda U_1^L$	$\lambda U_1^L < c_1 \leq \lambda U_1^B$	$\lambda U_1^B < c_1 \leq \lambda U_1^N$	$\lambda U_1^N < c_1 \leq \lambda \mathbb{E}[v_1]$	$\lambda \mathbb{E}[v_1] < c_1 \leq \Delta^L$
N	W^N	W^N	W^N	0	0
B	W^*	W^*	W^N	W^N	0
L	W^L	W^N	W^N	$\tilde{W}^L(c_1)$	$\tilde{W}^L(c_1)$
L'	W^*	W^*	W^N	$\tilde{W}^L(c_1)$	$\tilde{W}^L(c_1)$

The comparison follows simply from the fact that $W^* > W^N, W^L \geq 0$ and that $W^N > \tilde{W}^L(c_1) \geq 0$.

Proposition 6 (a) *Regime B dominates regime N, and strictly so if $c_1 \leq \lambda U_1^B$ or $\lambda U_1^N < c_1 \leq \lambda \mathbb{E}[v_1]$.*

- (b) *Regime B dominates regime L if $c_1 \leq \lambda \mathbb{E}[v_1]$, and strictly so if $c_1 \leq \lambda U_1^B$ or $\lambda U_1^N < c_1 \leq \lambda \mathbb{E}[v_1]$; Regime L dominates regime B strictly if $\lambda \mathbb{E}[v_1] < c_1 \leq \Delta^L$.*
- (c) *Regime L' dominates regime L, and strictly so if $c_1 \leq \lambda U_1^B$.*
- (d) *Regime B dominates regime L' if $\lambda U_1^N < c_1 \leq \lambda \mathbb{E}[v_1]$, but regime L' dominates regime B if $\lambda \mathbb{E}[v_1] < c_1 \leq \Delta^L$.*

There are several noteworthy aspects of this welfare comparison. First, permitting the target to at least offer breakups is preferred to outlawing all lockups. In fact, one can implement the first best with this policy if the first buyer's bidding cost is not too large ($c_1 \leq \lambda U_1^B$). Second, permitting the target to offer a stock lockup can support some takeover activity even when the bidding cost is high and/or the informational externalities problem is severe. Nonetheless this policy may be dominated by permitting only breakup fees, as stock lockups induce either too much competition (when $c_1 \leq \lambda U_1^L$) or too little competition (when $\lambda U_1^B < c_1 \leq \lambda U_1^N$ and $\lambda U_1^N < c_1 \leq \lambda \mathbb{E}[v_1]$). Third, permitting a stock lockup to be offered only to the first bidder (i.e., regime L') combines the benefit of regimes B and L, and thus dominates regime L. However this policy is worse than permitting only breakup fees if the first bidder would participate with a breakup fee alone.

4 Extensions

This section sketches out extensions of our analysis to some different settings.²⁸

4.1 Multiple Second Bidders

Our findings about the optimality of breakup fees and the affects of lockups extend to settings where there are any number of bidders. To illustrate, suppose there are $N > 2$ bidders, $1, 2, \dots, N$ who have the same private value distribution but different costs of entry, c_i , that is ordered so that $c_i \leq c_{i+1}$, for all i . The efficient takeover then involves a sequential process whereby each buyer makes an entry decision according to the indexed order, with buyer $n = 1, \dots, N$ incurring c_n to enter if and only if the highest valuation among the previous entrants is less than some threshold value v_n^* . The threshold value declines monotonically with the buyer index, given that a lower indexed buyer has a lower cost. This efficient process can be implemented by a target

²⁸ A detailed analysis of some these extensions are available from the authors upon request.

that is allowed to use breakup fees to subsidize entry. This result holds in a model of sequential takeover bidding that extends the basic model in Section 3 (with the time line described in Figure 1), where the target approaches the buyers in the order she chooses.

The bargaining process is formally described as follows. The target approaches the buyers in the indexed order. Suppose all buyers $1, \dots, (n-1)$ have made their entry decisions, and buyer n is about to make an entry decision. We call such a stage round n . Let \tilde{b}_I be the current standing bid, equal to the highest amount that has been bid by any buyer up to this point, and let I be the "incumbent" who made that bid. We call that (n, \tilde{b}_I) a state. The following bidding game is played in that state.

Sequential Bidding Process:

- (i) I bids $\bar{b}_I \geq \tilde{b}_I$ to acquire T . If T accepts, the process ends. If T rejects the bid or he may offer a fee $\tau_n \geq 0$ to buyer Bn to enter the bidding. If Bn refuses then the state becomes $(n+1, \tilde{b}_I)$ and the process starts over again at (i) in round $n+1$. If buyer n accepts offer he incurs a cost c_n and learns his value, v_n .
- (ii) Buyers n and I compete in an ascending bid auction to determine which buyer becomes the new incumbent. The bidding begins at \tilde{b}_I , the current standing offer.
- (iii) The last bidder remaining becomes the new incumbent and the new winning bid becomes the new standing bid, \tilde{b}'_I .
- (iv) The process returns to (i) in round $n+1$ with state $(n+1, \tilde{b}'_I)$ where it begins once again.

The process begins initially in state $(1, 0)$ in round 1. The process terminates when T accepts a bid, or with the conclusion of the ascending bid in round N . This process results in the efficient allocation of the target to the highest valued buyer who competes. Moreover, the preemption behavior by an incumbent bidder (i.e., the bidder with the highest valuation among those who have entered) is also efficient in that an incumbent bidder preempts subsequent entry if and only if his valuation exceeds the efficient threshold v_n^* in round n . This process determines the highest valued buyer in the same way the two buyer case works. At each stage, the incumbent buyer's bid signals whether her value is a high enough one to preempt entry by further buyers, or a low enough value to warrant entry by the next potential buyer in line. Just as in the two buyer case,

breakup fees enable the target to internalize the joint surplus of the subsequent entrants, thus leading to the efficient preemption behavior.²⁹

4.2 Uncertain entry costs

Our main findings regarding the benefit of breakup fees extend to the setting where B2's costs are private and uncertain to T and B1. We sketch the arguments here; more detailed explanations are available from the authors. To illustrate, suppose B2's cost c_2 is \underline{c} or \bar{c} with probabilities p and $1 - p$, where $0 < \underline{c} < \bar{c}$. B2 privately observes his cost c_2 prior to bidding. Uncertain entry cost of B2 changes the socially efficient entry/preemption. It is characterized by two threshold types of bidder 1, v_L^* and v_H^* in $[\underline{v}, \bar{v}]$, such that bidder 2 should never enter (no entry) if $v_1 \in A = (v_H^*, \bar{v}]$; he should enter only when $c = \underline{c}$ ("partial entry") if $v_1 \in B = (v_L^*, v_H^*)$; and he should always enter if $v_1 \in C = [\underline{v}, v_L^*]$. Clearly, the threshold must satisfy,

$$\mathbb{E}_{v_2}[\max\{v_2 - v_H^*, 0\}] = \underline{c} \quad (12)$$

$$\mathbb{E}_{v_2}[\max\{v_2 - v_L^*, 0\}] = \bar{c}. \quad (13)$$

Without any lockups (i.e, in regime N), B1's preemptive bidding equilibrium will also have two threshold types supported by two preemptive bids, $(v_L^N, v_H^N, b_L^N, b_H^N)$ such that B1 with $v_1 > v_H^N$ makes a high bid b_H^N which preempts both types of B2; B1 with $v_1 \in (v_L^N, v_H^N)$ makes lower partially-preemptory bid which deters entry by only low high cost type B2; and B1 with $v_1 < v_L^N$ makes non-preemptory zero bid, leading to entry by both types of B1. For the precisely the same reason as before, this equilibrium involves excessive preemption with $v_H^N < v_H^*$ and $v_L^N < v_L^*$.

Breakup fees improve the efficiency of entry decision for much of the same reason as before; namely, the ability by T to credibly threaten to subsidize B2's entry disciplines B1's preemptory power. But the full efficiency is not achieved, unlike the case with no uncertainty. In regime B, the preemptive bidding equilibrium is again characterized by two threshold types and two preemptive bids, $(v_L^B, v_H^B, b_L^B, b_H^B)$, with type $v_1 > v_H^B$ of B1 making full preemptory bid b_H^B , type $v_1 \in (v_L^B, v_H^B)$ making partial preemptory bid, and type $v_1 < v_L^B$ making non-preemptory bid. As before, the threat of offering breakup fees influenced the preemption behavior, but breakup

²⁹This process also accommodates cases in which the buyers also differ in their private value distributions, as well as costs. See the supplementary notes available from the authors.

fees are never used on the equilibrium path, despite the uncertainty about B2's entry cost. The reason is that T and B1 have symmetric information about B2, which means that on the equilibrium path both parties have same belief about exactly what is required for T to accept B1's preemptive bid.

The resulting entry behavior is more efficient than in regime N. To begin, the threshold for the partial preemption is efficient with $v_L^B = v_L^*$. The logic for this is the same as before: Equilibrium requires B1 with the threshold type to be indifferent between no preemption and partial preemption; and T becomes residual claimants of the surplus associated with the two options, partial entry and (subsidized) full entry, and must be indifferent in equilibrium. The same is not true with the threshold for the full preemption, as it is excessive with $v_H^B < v_H^*$. The reason is T is unable to capture the full residual surplus from partial preemption when it deviates and subsidizes only the low cost type. In the latter case, if B2 were indeed of high cost, he will not respond to T's offer, and T gets no payoff, instead of the bid b_L^B B1 would have offered if he had opted to partially preempt. While type v_H^B is indifferent between full preemption and partial preemption, T is not entitled to the residual surpluses associated with the two options at the time of its choice. This inability to capture full residual surplus from partial preemption leads to excessive preemption in this case. This inefficiency notwithstanding, regime B produces a strictly more efficient entry behavior than regime N, for $v_H^B \geq v_H^N$. In this sense, the main tenet of this paper remains valid.

4.3 Unfaithful management

To this point our analysis presumes a faithful target management representing shareholder interest in managing the takeover. In practice, however, a target management may act to maximize their private benefit from retaining control of the company or from "steering" the target to a sympathetic buyer willing to treat existing management preferentially. Some analysts question the prudence of allowing lockups of any kind in view of management's potential for abusing shareholder interests.

All lockups may be misused by management for their private gain. However, the extent of misuse varies with different lockup provisions. While a full accounting of lockup abuse is not possible here, our findings suggest at least that breakup fees are less susceptible than stock lockups to misuse by a management seeking private gains from takeover. This follows because breakup fees cannot be employed to either distort the outcome of bidder competition or to

shift rents from an unfavored bidder to a favored one. Our analysis indicates that once an ascending auction begins, the high valuation bidder always wins, regardless of the breakup fees management has offered. Further, provided the size of breakup fees is appropriately capped, a breakup fee offered to an initial bidder can not discourage additional bidders from competing for the target.³⁰

In considering the possible misuse of a breakup fee, it is instructive to consider three cases. First imagine an “entrenched” board that is opposed even to a profitable takeover. It is reasonable to assume that even such a board will seek to maximize revenue once a takeover becomes inevitable. With such a board, the policy of permitting only breakup fees (“regime B”) dominates prohibiting all lockups (“regime N”), both from a social welfare and share holder viewpoint. In both regimes, the board will not solicit initial takeover bids. However, if a buyer seriously bids to acquire the target, making takeover inevitable, the board will optimally employ breakup fees to solicit other bids to increase the revenue from the takeover in regime B. By contrast, in regime N, the board would be unable to induce sufficient competition for the target.

Next imagine the board prefers takeover by a particular buyer. Here the board may offer the favored bidder a breakup fee in regime B, but this option is precluded in regime N. Further, offering the favored buyer a breakup fee (with an appropriate cap) will not discourage additional bidders from entering the competition. Hence, social welfare and shareholder revenues are at least as great in regime B relative to regime N.

Finally imagine the board is biased against a bidder who already has initiated a hostile takeover. In regime B, the target board will offer a breakup fee to induce further bidding by a white knight whereas this option is precluded in regime N. As before, offering a second bidder a breakup fee will not discourage the hostile bid in the first place. Hence, again the breakup fee is desirable.

In principle, a breakup fee restricted not to exceed the cost of bid preparation would suffice to insure they are properly employed. Whether courts would possess sufficient knowledge of bidding costs to set appropriate breakup fee caps is debatable. Nonetheless, it seems clear that allowing conservatively capped breakup fees would be preferable in most cases to banning lockups all together.

Unlike breakup fees, stock lockups appear susceptible to a misuse by an unfaithful board. In particular, the ability of a stock lockup to shift rents away from non-recipient bidders can

³⁰ As we noted earlier, if breakup fees are less than \underline{v} , they do not affect the payoffs of non-recipient bidders.

make it an effective device for manipulating the outcome of takeover, if the (unfaithful) board so wishes. For instance, an “entrenched” target board can fend off, or even prevent, a hostile takeover attempt, by threatening to offer a stock lockup to a “white knight” favorable to the board. Such a threat is much more credible and effective than that of using a breakup fee, since stock lockups enable the target board to shift the burden of subsidizing competition to the hostile bidder.

5 Conclusion

Our analysis reveals some form of lockups is required to induce sufficient competition in takeover contests, and to compensate first buyers for initiating acquisitions. A widespread ban of lockups by the courts would, we believe, unduly inhibit the takeover process. The courts should be at least permissive towards the target’s use of breakup fees. When management acts to maximize shareholder value from takeover, we find breakup fees induce efficient allocation of the target to the highest valued buyer in a takeover auction. Further, employing breakup fees to subsidize bidding increases the efficiency of entry decisions of initial and follow-on buyers, relative to settings where all lockups are prohibited. In addition, the desirable properties of breakup fees appear to extend even to situations where the target board is unfaithful to the shareholder interests as we have argued in the previous section.

By contrast, stock lockups reduce the social surplus from acquisitions by permitting recipient buyers with lower valuations to acquire the target. Further, a second-buyer stock lockup will encourage too much competition, whereas a first-buyer lockup will cause excessive preemption of second bidders, thus inducing too little competition. Despite the inefficiencies, we predict target management would prefer to employ stock lockups unless discouraged by the courts.³¹ Stock lockups permit the target to induce buyers to participate at lower cost by favoring the recipient buyer at the expense of other rival bidders. We expect this preference for stock lockups to be even more pronounced among unfaithful target boards desiring to retain control of the target or to bias takeover in favor of an accommodating buyer. Since stock lockups reduce takeover rents of non-recipients, they may be employed by an unfaithful board to defeat a takeover attempt. Our findings suggest that courts should encourage the use of breakup fees in place of stock lockups to manage the takeover process.

³¹ As mentioned earlier, the courts’ more lenient treatment of breakup fees appears largely responsible for the less frequent use of stock lockups. See Coates and Subramanian (2000).

Appendix: Proofs

Proof of Corollary 2. The last inequality holds since the recipient with v_r could bid $\frac{v_r + \mu v_0 - \tau}{1 + \mu}$ and win against the same types of buyer n as when $(\tau_r, \mu_r) = (0, 0)$ and thus secure at least the same expected payoff, but he can do better with his equilibrium strategy.

The second inequality is proven as follows. Observe first that the joint payoff of the target and the recipient with valuation v_r is simply v_r when $(\tau_r, \mu_r) = (0, 0)$, since when the latter wins the realized surplus for the coalition is v_r and when he loses the other bidder pays v_r . Now suppose $\mu_r > 0$. If the recipient wins, then the realized surplus for the coalition is again v_r , but when he loses, the coalition collects the total payment from the non-recipient with valuation v_n , equal to

$$b_r(v_r) + \tau_r + \mu_r(b_r(v_r) - v_0) = \max\{\phi_n^L(v_r), \underline{v}_n\},$$

which is strictly greater than v_r . This proves the second inequality for all (v_1, v_2) . The inequality is strict whenever the non-recipient would have won with $(\tau_r, \mu_r) = (0, 0)$, which is a positive probability event, given $\underline{v}_r < \bar{v}_n$.

The first inequality (weak and strict) follows directly from the first since

$$\pi_0(v_1, v_2; 0, 0) + \pi_r(v_1, v_2; 0, 0) + \pi_n(v_1, v_2; 0, 0) \geq \pi_0(v_1, v_2; \tau_r, \mu_r) + \pi_r(v_1, v_2; \tau_r, \mu_r) + \pi_n(v_1, v_2; \tau_r, \mu_r),$$

where the inequality holds since the allocation is efficient when $(\tau_r, \mu_r) = (0, 0)$ (see Proposition 1). ■

Proof of Proposition 3. Part (a) follows directly from Corollary 1. Part (b) follows from the revenue equivalence argument, which enables us to express the target's expected surplus given (τ_r, μ_r) , as a function of the equilibrium allocation, $\phi_i(v_j) = \sup\{v_i \in V_i | b_i(v_i) < b_j(v_j)\}$:

$$\begin{aligned} & \Pi_0(\tau_r, \mu_r) \\ = & \mathbb{E}_{\{v_i \geq \phi_i(v_j)\}}[v_i - h_i(v_i)] + \mathbb{E}_{\{v_i < \phi_i(v_j)\}}[v_j - h_j(v_j)] \\ & - \mathbb{E}_{v_2}[\pi_1(\underline{v}_1, v_2; \tau_r, \mu_r)] - \mathbb{E}_{v_1}[\pi_2(v_1, \underline{v}_2; \tau_r, \mu_r)] \\ = & \mathbb{E}_{\{v_i \geq \phi_i(v_j)\}}[v_i - h_i(v_i) - \{v_j - h_j(v_j)\}] + \mathbb{E}[v_j - h_j(v_j)] \\ & - \mathbb{E}_{v_2}[\pi_1(\underline{v}_1, v_2; \tau_r, \mu_r)] - \mathbb{E}_{v_1}[\pi_2(v_1, \underline{v}_2; \tau_r, \mu_r)]. \end{aligned}$$

If $F_i(\cdot) = F_j(\cdot)$, then the integrand of the first term in the last line is positive if and only if $v_i > v_j$, so the expected surplus is maximized when $\phi_i(v) = v$ for all v . This can be implemented

by setting $(\tau_r, \mu_r) = (0, 0)$ for $r = 1, 2$, which also ensures that the bidders' benchmark payoffs are zero. Hence, offering no lockup is optimal for the target in this case.

Suppose now $h_i(\cdot) \leq h_j(\cdot)$. Notice that the integrand of the first term in the last line is positive whenever $v_i \leq v_j$. With $(\tau_r, \mu_r) = (0, 0)$, $\phi_i(v) = v$ for all v , and the bidders' benchmark payoffs are all zero since $\underline{v}_i = \underline{v}_j$. Choosing $\mu_j > 0$ can only raise $\phi_i(v)$ above v , which reduces the region in which the positive integrand value is realized, without any other effect. Thus, $\mu_j = 0$ is optimal. We already have shown that $\tau_j = 0$ is optimal given that $\mu_j = 0$. Hence, no lockup to bidder j is optimal. The same logic implies that a lockup to bidder i is optimal if $h_i(v) < h_j(v)$ for a positive measure of v . Raising μ_i slightly from zero expands the region in which the integrand is strictly positive in this case, and v_0 can be so that the benchmark payoffs remain zero. ■

Proof of Lemma 1. Fix regime $j = N, B, L$. For brevity, we construct equilibrium strategies and beliefs for the second case. (The strategies/beliefs for the first case analogous.) In this case, B1 bids the minimum bid of zero if $v_1 < \hat{v}^j$ and \hat{b}^j if $v_1 \geq \hat{v}$. T and B2 then form a belief as follows. If B1's initial bid is strictly less than \hat{b}^j , then the posterior distribution is $F_i(v) = \min\{\frac{F(v)}{F(\hat{v}^j)}, 1\}$. If B1's initial bid is no less than \hat{b}^j , then the posterior distribution is $F_i(v) = \{\max\{\frac{F(v)-F(\hat{v}^j)}{1-F(\hat{v}^j)}, 0\}$. T then accepts B1's bid if it is no less than \hat{b}^j ; otherwise, T rejects the bid and offers no lockup to B2. B2 then invests c_2 if and only if B1's initial bid is strictly less than \hat{b}^j . Whenever the ascending auction is played, the strategies described in Propositions 1 and 2 are played, given any lockup that may be offered to B2 (off the equilibrium path). That this strategy profile/beliefs is a Perfect Bayesian equilibrium follows from the definitions of \hat{v}^j , Propositions 1 and 2, and from the fact that $v_1 - \mathbb{E}_{v_2}[\pi_1(v_1, v_2; 0, 0)] = \mathbb{E}_{v_2}[\min\{v_1, v_2\}]$ is nondecreasing in v_1 , which implies that

$$v_1 - \hat{b}^j \begin{cases} > \\ \geq \\ < \\ \leq \end{cases} \mathbb{E}_{v_2}[\pi_1(v_1, v_2; 0, 0)] \text{ if } v_1 \begin{cases} > \\ \geq \\ < \\ \leq \end{cases} \hat{v}^j,$$

justifying B1's decision on the initial bid. ■

Proof of Proposition 4. Observe first that

$$\Pi_0(0, 0; \hat{v}) - \hat{b}(\hat{v}) = \mathbb{E}[\min\{v_1, v_2\} | v_1 \geq \hat{v}] - \mathbb{E}[\min\{\hat{v}, v_2\}] > 0, \quad (14)$$

for all $\hat{v} \in [\underline{v}, \bar{v})$, so T will wish to reject \hat{b}^j if B2 is willing to enter without a lockup and $\hat{v} < \bar{v}$. This means that, in regime N, entry will occur if and only if $\Pi_2(0, 0; \hat{v}) - c_2 = 0$, so $\hat{v}^N = \sup\{\hat{v} | \Pi_2(0, 0; \hat{v}) - c_2 \geq 0\}$. Since

$$\Pi_2(0, 0; \hat{v}) - c_2 = \mathbb{E}[\max\{v_2 - v_1, 0\} | v_1 \geq \hat{v}] - c_2 < \mathbb{E}[\max\{v_2 - \hat{v}, 0\} | v_1 \geq \hat{v}] - c_2 = \Gamma^*(\hat{v}),$$

for any $\hat{v} < \bar{v}$, and since $\hat{v}^* < \bar{v}$, it must be that $\hat{v}^N < \hat{v}^*$.

Next, (14) also implies that, in regimes B and L, T will wish to subsidize B2 to enter whenever the joint surplus of T and B2 from the entry exceeds the preemptive bid. The reason is that, in each of the two regimes, T can offer a lockup just sufficient for B2 to enter without losing money. Summarizing, for $j = B, L$, we must have $\hat{v}^j \geq \hat{v}^N$, and, for $\hat{v} \geq \hat{v}^N$,

$$\Gamma^j(\hat{v}) = \begin{cases} \max_{\tau_2} \Pi_0(\tau_2, 0|\hat{v}) + \Pi_2(\tau_2, 0|\hat{v}) - c_2 - \hat{b}(\hat{v}) & \text{if } j = B, \\ \max_{\tau_2, \mu_2} \Pi_0(\tau_2, \mu_2|\hat{v}) + \Pi_2(\tau_2, \mu_2|\hat{v}) - c_2 - \hat{b}(\hat{v}) & \text{if } j = L. \end{cases}$$

As shown in the text, for any $\tau_2 \geq 0$,

$$\Pi_0(\tau_2, 0|\hat{v}) + \Pi_2(\tau_2, 0|\hat{v}) - c_2 - \hat{b}(\hat{v}) = \Gamma^*(\hat{v}),$$

so $\hat{v}^B = \hat{v}^* > \hat{v}^N$.

Finally, Corollaries 2 and 1 imply that, for any $\mu_2 > 0$ and \hat{v} ,

$$\begin{aligned} \Pi_0(\tau_2, \mu_2|\hat{v}) + \Pi_2(\tau_2, \mu_2|\hat{v}) &= \mathbb{E}[\pi_0(v_1, v_2; \tau_2, \mu_2) + \pi_2(v_1, v_2; \tau_2, \mu_2)|v_1 \geq \hat{v}] \\ &> \mathbb{E}[\pi_0(v_1, v_2; 0, 0) + \pi_2(v_1, v_2; 0, 0)|v_1 \geq \hat{v}] \\ &= \mathbb{E}[\pi_0(v_1, v_2; \tau_2, 0) + \pi_2(v_1, v_2; \tau_2, 0)|v_1 \geq \hat{v}] \\ &= \Pi_0(\tau_2, 0|\hat{v}) + \Pi_2(\tau_2, 0|\hat{v}), \end{aligned}$$

which implies that $\hat{v}^L > \hat{v}^B$. ■

Proof of Corollary 3. The first statement clearly follows from Proposition 4 and Lemma 1. To compare the target's equilibrium payoffs across legal regimes, consider an arbitrary equilibrium in which B1 preempts successfully with a bid of $\hat{b}(\hat{v}) = \mathbb{E}[\min\{\hat{v}, v_2\}]$ if $v_1 \geq \hat{v}$, and an efficient auction with each bidding his own valuation arises if $v_1 < \hat{v}$. The target's expected payoff from such an equilibrium would be

$$U_0(\hat{v}) := \mathbb{E}_{\{v_1 \geq \hat{v}\}}[\min\{\hat{v}, v_2\}] + \mathbb{E}_{\{v_1 < \hat{v}\}}[\min\{v_1, v_2\}] = \mathbb{E}[\min\{\hat{v}, v_1, v_2\}],$$

which is strictly increasing in $\hat{v} \in (\underline{v}, \bar{v})$. Meanwhile, B1's expected payoff from such an equilibrium is

$$U_1(\hat{v}) := \mathbb{E}_{\{v_1 \geq \hat{v}\}}[v_1 - \min\{\hat{v}, v_2\}] + \mathbb{E}_{\{v_1 < \hat{v}\}}[\max\{v_1 - v_2, 0\}] = \mathbb{E}[\max\{v_1 - \hat{v}, v_1 - v_2, 0\}],$$

which is strictly decreasing in $\hat{v} \in (\underline{v}, \bar{v})$. Now observe that $U_i^j = U_i(\hat{v}^j)$, $j = N, B, L$, $i = 0, 1$. Then, Proposition 4 implies that $U_0^L > U_0^B > U_0^N$ and that $U_1^L < U_1^B < U_1^N$. ■

Proof of Lemma 2. Given the arguments preceding the proposition, it remains to show that $\tilde{W}^L(\tau_1, \mu_1) < W^N$ and $\tilde{U}_0^L(\tau_1, \mu_1) < U_0^N$, for any $\mu_1 > 0$. The first inequality holds since the allocation is inefficient conditional on B2's entry, which implies that $\tilde{W}^L(\tau_1, \mu_1) < (\tilde{v}^L)$ and since $\tilde{v}^L < \hat{v}^N$, which implies that $(\tilde{v}^L) < (\hat{v}^N) = W^N$.

To prove the second inequality, following the revenue equivalence in the proof of Proposition 3, we can write:

$$\begin{aligned}
\tilde{U}_0^L(\tau_1, \mu_1) &= \mathbb{E}_{\{v_1 < \min\{\phi_1(v_2), \tilde{v}^L\}\}} [v_2 - h_2(v_2) - \{v_1 - h_1(v_1)\}] + \mathbb{E}[v_1 - h_1(v_1)] \\
&\quad - \mathbb{E}_{v_2}[\pi_1(\underline{v}, v_2; \tau_1, \mu_1)] - \mathbb{E}_{v_1}[\pi_2(v_1, \underline{v}; \tau_1, \mu_1)] \\
&\leq \mathbb{E}_{\{v_1 < \min\{v_2, \tilde{v}^L\}\}} [v_2 - h_2(v_2) - \{v_1 - h_1(v_1)\}] + \mathbb{E}[v_1 - h_1(v_1)] \\
&\quad - \mathbb{E}_{v_2}[\pi_1(\underline{v}, v_2; \tau_1, \mu_1)] - \mathbb{E}_{v_1}[\pi_2(v_1, \underline{v}; \tau_1, \mu_1)] \\
&< \mathbb{E}_{\{v_1 < \min\{v_2, \tilde{v}^N\}\}} [v_2 - h_2(v_2) - \{v_1 - h_1(v_1)\}] + \mathbb{E}[v_1 - h_1(v_1)] \\
&\quad - \mathbb{E}_{v_2}[\pi_1(\underline{v}, v_2; \tau_1, \mu_1)] - \mathbb{E}_{v_1}[\pi_2(v_1, \underline{v}; \tau_1, \mu_1)] \\
&\leq \mathbb{E}_{\{v_1 < \min\{v_2, \tilde{v}^N\}\}} [v_2 - h_2(v_2) - \{v_1 - h_1(v_1)\}] + \mathbb{E}[v_1 - h_1(v_1)] \\
&= U_0^N.
\end{aligned}$$

The first inequality holds since $\phi_1(v_2) \leq v_2$ (due to $\mu_1 > 0$) and $v_2 - h_2(v_2) > v_1 - h_1(v_1)$ whenever $v_1 < v_2$. The second inequality holds since $\tilde{v}^N > \tilde{v}^L$ and $v_2 - h_2(v_2) > v_1 - h_1(v_1)$ whenever $v_1 < v_2$. The third inequality follows since the benchmark type of each buyer receives zero payoff in regime N. Consequently, $\tilde{U}_0^L(\tau_1, \mu_1) < U_0^N$ if $\mu_1 > 0$. ■

Proof of Proposition 5. As observed in the text, Lemma 2 implies that the target will never offer any lockup if $c_1 \leq \lambda U_1^j$ in regime $j = N, B, L$, and the social welfare realized in this case is described in Corollary 3. We thus consider the case in which $c_1 > \lambda U_1^j$. In regime N, there is no takeover, so the social welfare realized is zero (i.e., the target value under the existing management). In regime B, T will induce B1 to entry with the minimal necessary breakup fee if and only if the joint surplus of T and B1 justifies the cost c_1 . The joint surplus is $\lambda \mathbb{E}[v_1]$ since, conditional on $q = 1$, either B1 acquires T in which case the coalition of T and B1 realize v_1 , or else B2 acquires T, in which case T receives B2's bid $v_1 - \tau_1$ and B1 receives a breakup fee τ_1 from B2. The welfare level realized is given by Lemma 2 whenever B1 is induced to enter. In regime L, again T induces B1 to enter with the minimal necessary lockup if and only if the joint surplus of T and B1 justifies the cost c_1 . Hence, B1 is induced to enter if and only if $\Delta^L := \max_{\tau_1, \mu_1} \lambda[\tilde{U}_0(\tau_1, \mu_1) + \tilde{U}_1(\tau_1, \mu_1)] > c_1$. The welfare level realized depends

on whether $\lambda U_1^L < c_1 \leq \lambda U_1^N$ or $\lambda U_1^N < c_1 \leq \Delta^L$. In the former case, T can induce B1 to invest by simply committing not to offer any lockup to B2 later on, which it can accomplish by offering an arbitrarily small amount of lockup (of either kind) to B1. Hence, the welfare realized would be W^N . In the latter case, a nontrivial subsidy is needed for B1 to participate. Corollary 2 implies that the lockup provision will contain a stock lockup. According to Lemma 2, the realized welfare level will be strictly less than W^N in this case. ■

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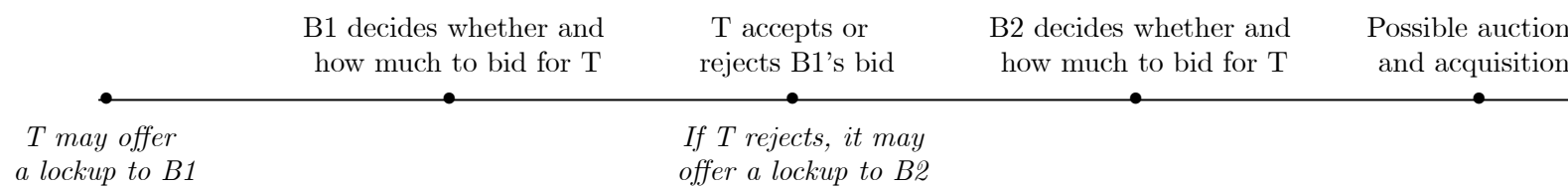


Figure 1: Sequence of events